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JUL 31 1990

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of)
Tennessee Valley Authority)

Docket No. 50-390

WATTS BAR NUCLEAR PLANT (WBN) - CABLE ISSUES AND ELECTRICAL ISSUES CORRECTIVE ACTION PROGRAM (CAP) PLANS - PROPOSED FINAL SAFETY ANALYSIS REPORT (FSAR) REVISIONS

This letter provides proposed updates to FSAR sections concerning the Cable Issues and Electrical Issues CAP Plans. The enclosure provides an advance copy of the proposed updates to Sections 8.1.5.2, 8.1.5.3, 8.2.1.6, 8.3.1.4.1, and 8.3.1.4.3 so that current information concerning the Cable Issues and Electrical Issues Plans at WBN is available for your review. These proposed revisions will be submitted in a subsequent FSAR amendment.

If there are any questions concerning this matter, please contact R. J. Stevens at (615) 365-8650.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

E. G. Wallace, Manager
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Regulatory Affairs

Enclosure
cc: See page 2

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U.S. Nuclear Regulatory Commission

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ENCLOSURE

PROPOSED REVISION TO FINAL SAFETY
ANALYSIS REPORT (FSAR) SECTIONS
8.1.5.2
8.1.5.3
8.2.1.6
8.3.1.4.1
8.3.1.4.3

ICEA P-54-440, Ampacities Cables Open-top Cable Trays

National Electrical Code, NFPA-70

2. Reference deleted by Amendment 63. 63

3. IEEE 450-1980, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Lead Storage Batteries for Generating Stations and Substations 56 63

4. IPCEA P-46-426, Power Cable Ampacities, Vol 1 - Copper Conductors.

5. ANSI C37.1-1962, Relays Associated with Power Switchgear. 63

6. ANSI C37.3-37.12, Alternating-Currant Power Circuit breakers

7. ANSI C37.19-1963, Low-Voltage a.c. Power Circuit Breakers and Switchgear Assemblies. 63

8. ANSI C37.20-1969 (C37.20-1974*), Switchgear Assemblies and Metal-Enclosed Bus. 63

9. ANSI C57, Transformers, Regulators, and Reactors.

10. NEMA AB-1-1964 (AB1-1975*), Molded-Case Circuit Breakers

11. NEMA EI-2-1966, Instrument Transformers

12. NEMA SG3-1965, Low-Voltage Power Circuit Breakers

13. NEMA SG4-1965, High-Voltage Power Circuit Breakers

14. NEMA SG5-1967, Power Switchgear Assemblies 63

15. NEMA SG6-1960, Power Switching Equipment

16. NEMA TR1-1971, Transformers, Regulators, and Reactors

17. NEMA MG1-1967, Motors and Generators

~~18. NEMA WC5-1968, Thermoplastic-Insulated Wire and Cable~~

19. IPCEA S-61-402, NEMA WC5 Thermoplastic-Insulated Thermoplastic-Jacketed Cables
FOR CABLE BEND RADIUS REFER TO TVA SUBMITTAL TO NRC (RIMS NO. L44900615803 ENCLOSURE 4)

20. IPCEA S-56-434, Polyethylene-Insulated Thermoplastic-Jacketed COMMUNICATION Cables

21. IPCEA S-66-524, Interim Standard No. 2, XLPE Insulation
FOR CABLE BEND RADIUS REFER TO TVA SUBMITTAL TO NRC (RIMS NO. L44900615803 ENCLOSURE 4)

22. NFPA No. 78-1971, Lightning Protection Code

23. IPCEA S-19-81, NEMA WC3-1969 IPCEA-NEMA Standards Publication, Rubber-Insulated Wire and Cable. Specific

*Revision of standard applies to fifth vital battery system. 63

S-28-357 WC1

references herein are from the fifth edition dated July 1969.
FOR CABLE BEND RADIUS REFER TO TVA'S SUBMITTAL TO NRC (RIMS NO. L44900615803 ENCLOSURE 4)

24. IPCEA ~~S-28, 357~~, NEMA ~~WC1~~-1963, American National Standards Institute Requirements for Asbestos, Asbestos-Varnished Cloth, and Asbestos-Thermoplastic Insulated Wires and Cable (C8.36-1962).
FOR CABLE BEND RADIUS REFER TO TVA'S SUBMITTAL TO NRC (RIMS NO. L44900615803 ENCLOSURE 4)

~~25~~ 26. NRC IE Circular No. 81-13, "Torque Switch Electrical Bypass Circuit for Safeguard Service Valve Motors."

Requirements reflected in this IE Circular are implemented within the Watts Bar design by wiring the control circuits in all active valves as follows:

1) The opening torque switch will be removed from the control circuit by removing connecting wires from the torque switch or by installation of a permanent electrical bypass.

2) The closing torque switch on all position seated valves will be removed from the control circuit by removing the connecting wires from the torque switch or by installation of a permanent electrical bypass.

3) The closing torque switch on all torque seated valves will be bypassed during travel by a position limit switch, allowing the torque switch to open the control circuit only on seating. (The list of the active motor operated valves which require torque switch bypass is identified in WBN calculation, "Selection Criteria for MOVs Requiring Thermal Overload Bypass," WBN-OSG4-095).

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8.1.5.3 Compliance to Regulatory Guides and IEEE Standards

The extent to which the recommendations of the applicable NRC regulatory guides the IEEE standards are followed is shown below. The symbol (F) indicates full compliance. Those which require further clarification or are not fully implemented are discussed in the footnotes as indicated.

Regulatory Guide 1.6 (Safety Guide 6), Revision 0 'Independence Between Redundant Standby (Onsite Power Sources and Between Their Distribution Systems.' (F) 63

Regulatory Guide 1.9 (Safety Guide 9), Revision 2, Selection of Diesel Generator Set Capacity for Standby Power Supplies.' (7) 63

Regulatory Guide 1.22 (Safety Guide 22), Revision 0, 'Periodic Testing of Protection System Actuation Functions.' (F) [Note 2 of Table 7.1-1] 63

Regulatory Guide 1.29, Revision 0, 'Seismic Design Classification.' (F) 6

Regulatory Guide 1.32 (Safety Guide 32), Revision 0, 'Use of IEEE Std 308-1971, 'Criteria for Class IE Electric Systems for Nuclear Power Generating Stations.' (F)

25 ~~26~~. ICEA S-68-516, NEMA WCB-1976, ICEA-NEMA STANDARDS PUBLICATION, ETHYLENE-PROPYLENE-RUBBER-INSULATED WIRE AND CABLE. FOR CABLE BEND RADIUS REFER TO TVA SUBMITTAL TO NRC (RIMS NO. L44900615803 ENCLOSURE 4).

In addition to the single failure criterion of IEEE 279, the following requirements of IEEE 279 are met as follows:

Testability: The overcurrent protection system provided for 6900-volt penetration circuits include drawn out-type relays which are field testable using manufacturer provided test sets or TVA test sets to simulate fault currents following established procedures. Low voltage power circuit breakers and molded case circuit breakers are field tested using test sets built by Multiamp Corporation or equal. Testing is done by simulating fault current following established procedures.

Periodic resistance measurement is not practical for containment penetration conductor overcurrent protection fuses. Resistance verification is performed as one of the final steps in the manufacturing process, assuring proper construction and rating. Manufacturers do not publish this baseline data since construction changes are made based on 55 design and material improvements. Because of this, no baseline data would be available if periodic resistance measurements were performed. Routine removal of fuses for testing is not prudent according to the manufacturer. Routine removal can result in damaging of the fuse holder and contact points. In the case of cable protecting fuses, the fuse would be physically destroyed when it was removed because of the crimped joint used to connect it. In lieu of field testing by resistance, we will establish 63 a fuse inspection and maintenance program that will ensure: (1) that the proper size fuse is installed, (2) that the fuse shows no sign of deterioration, and (3) that the fuse connections are tight and clean. (See IEEE Std 242-1975, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems). Should a problem arise with a specific brand or model of fuse, necessary corrective action would be initiated through the plant's experience review program.

Penetration protective devices in 480V circuits energized during plant operation are mounted in either motor control centers, Class 1E low 63 voltage switchgear, or panel boards. Both Class 1E and non-Class 1E motor control centers are ITE Imperial Corporation series 5600 supplied under the same contract. All 480V non-Class 1E distribution equipment that houses penetration protective devices are located in the same seismic structure as Class 1E distribution equipment. Equipment bought to Class 1E standards is qualified to operate both during and after an operating basis earthquake normal control power for circuit breakers 1812 and 2814 is supplied from the existing 125 VDC vital battery board II. This arrangement provides a physically and electrically independent supply control power for each switchgear. The cables providing this control power have been uniquely identified as P and R circuits. ~~(for a discussion of P and R separations requirements, refer to Section 8.3.1.4.3)~~ ~~and have been routed in separate cable trays and conduits from the battery~~ boards to the switchgear, ~~therefore ensuring adequate physical separation.~~

"P"-designated cable/wiring shall be separated from "R"-designated cable/wiring. The minimum separation distance between "P" and "R" cable/wiring shall be that they do not touch.

The alternate control power for circuit breakers 1712 and 2714 is supplied from existing 125 vdc vital battery board III: the alternate control power for circuit breakers 1812 and 2814 is supplied from existing 125 vdc vital battery board IV. These cables have been routed such that with either breakers 1712 and 2714 or breakers 1812 and 2814 receiving control power from the designated alternate source (and with the other breaker pair receiving control power from the normal source) physical and electrical independence of control power for each switchgear is maintained. 63

Manual control of the circuit breakers is provided on the electrical control board in the main control room where the

Conductor sizing, in general, is accomplished by applying an appropriate multiplying factor to the load current for the specified load type.

~~Selection of conductor sizes are based on "Power Cable Ampacities," published by the Insulated Cable Engineers Association (ICEA), ICEA-P-46-426 and P-54-440~~. The effects on cable ampacity of environmental conditions and cable installation configuration are considered in the conductor size selection process. Circuit breakers are used for high-speed clearing of faults to prevent damage to the 3-phase power cables. For power cables rated above 600 volts between conductors, the minimum size is 2/0 AWG. ~~Ampacity of cables feeding motor circuits is based on not less than 125 percent of full-loaded current~~. Power and control cables which are routed on cable trays carrying essential cables are capable of passing the ICEA standard vertical flame test. 63

Selection of conductor sizes is based on ICEA P-46-426, "Power Cable Ampacities," ICEA P-54-440, "Ampacities Cables in Open-Top Cable Trays," and the National Electrical Code (NFPA-70).

Conduit containing only one cable is sized for a maximum of 53 percent cable fill. Conduit containing two cables is sized for a maximum of 31 percent cable fill, and conduit containing three or more is sized for a maximum of 40 percent cable fill of the inside area of the conduit. Medium-voltage (6900-volt) power cables are routed on trays with other cables of the same voltage. All 6900-volt cables larger than 2/0 AWG are grouped as a 3-phase circuit and are separated from other circuits by a nominal distance equal to the radius of the larger cable. TVA takes no credit for spacing of medium voltage cables for ampacity purposes. The 6900-volt cables which are 2/0 AWG may be laid at random on cable trays and are separated (as described above) from grouped 3-phase circuits. The nominal spacing may be less where cables enter or exit a tray and at tray fittings where necessary to prevent exceeding the minimum cable bend radius. However, nominal spacing is restored as soon as practical. Low-voltage power cables rated 600 volts and below are routed on cable trays with other power cables of the same voltage. Low-voltage power cable tray fill shall be limited to a maximum of 30 percent of the cross-sectional area of the tray, except when a single layer of cable is used. Cable tray fill for control and instrumentation cables shall be limited to a maximum fill of 60 percent of the cross-sectional area of the tray. 63

8.3.1.4.2 Cable Routing and Separation Criteria

Electrical wiring for the GSPS, which includes the RPS, ESF, ESAS, and Class 1E electric systems, are segregated into separate divisions of separation (channels or trains) such that no single event, such as a short circuit, fire, pipe rupture, missile, etc., is capable of disabling sufficient equipment to prevent safe shutdown of the reactor, removal of decay heat from the core, or to prevent isolation of the primary containment. The degree of separation required for GSPS electrical cables varies with the potential hazards in a particular zone or area of the power plant. These criteria do not attempt to classify every area of the nuclear plant, but specifies minimum requirements and guidelines that have been applied with good

Vital instrument cables for the generating station protection system (GSPS) which includes the RPS and ESF may be routed in the same conduits, wireways, or cable trays provided the circuits have the same characteristics such as power supply and channel identity (I, II, III, or IV).

Automatic actuation and power circuits for the generating station protection system which includes the RPS and ESF may be routed in the same conduits, wireways, or cable trays provided the circuits have the same characteristics such as power supply and train identity (train A or train B).

Unit 1 analog circuits and Unit 2 analog circuits may be routed in the same conduits, cable trays, or wireways provided the circuits have the same characteristics such as power supply and channel identity (I, II, III, or IV). In like manner, Unit 1 train A cables may be routed in the same conduits, cable trays, and wireways as Unit 2 train A cables. Unit 1 train B cables may be routed in the same conduits, cable trays, or wireways as Unit 2 train B cables.

Cables for non-safety-related functions are not run in conduit
used for essential circuits except at terminal equipment where
only one conduit entrance is available. The non-safety-related
cable is separated from the safety-related cable as near the
device as possible. Generally, the non-safety-related cables are
for annunciator functions. Exposed conduits containing redundant 48
cables are separated by a minimum 1-inch air gap or by a minimum
1/2-inch thickness of Marinite (or its equivalent) fire-resistant
barrier between conduits. Although there is no established
minimum separation requirement between open top nondivisional
cable trays and conduit containing redundant cables, it is
concluded based on the following, that safety-related cables are
not degraded. Cables installed prior to October 18, 1984 are 56
coated with a fire resistant material. This coating
significantly reduces the ignitibility and combustibility of
cable insulation. TVA conducted fire tests, externally initiated
by a propane burner, on a full scale mockup of trays loaded with
cables coated with a fire-resistant material. No self-sustaining
fire could be established until the coating was fractured and
cables separated. The cable coating also protects against
development of a fire from electrical faults since it restricts
availability of oxygen needed for combustion. Therefore, TVA 56
takes credit for the coating on cables not qualified to IEEE 383
flame test or equivalent, together with adequate circuit
protective device(s) (as described below) as meeting the intent
of Regulatory Guide 1.75 requirements to achieve independence
between Class IE and non-Class IE cables routed in cable trays or
conduits. Effective October 18, 1984, the use of coating on IEEE 55
383-1974 cables is not required except when the coating is used
as part of electrical penetration fire stops as discussed in
8.3.1.4.4. In all cable coating applications, up to 10 cables
not qualified to the IEEE 383 flame test or equivalent may remain 56
uncoated on cable trays, unless small gaps or cracks in the coating exist in the tray segment. In such case, up to 9 cables not qualified to the IEEE 383 flame test or equivalent may remain uncoated.

suffix S added to their respective conduit and cable numbers. The redundant feeder supply cables to the transfer devices have channel or train identification and separation depending on their application.

All power and control cables from the ADGU down to the first transfer point in 57
the ADGU building are designed as S cables and are routed as such. Four cable sets (one set per each EDGU, two for train A and two for train B) are routed in cable trays in the EDGU conduit interface rooms (see Figure 8.3-57 through 8.3-59) and ADGU building and via a conduit bank between the buildings. It is 63
not necessary for these train A and B trays to be separated by the minimum distance since no more than one train will be operational at any given time. During normal operations the four cable sets routed through trays A and B, respectively will not be energized nor electrically connected at either end. The only time any of the four cable sets can be energized is after the additional diesel generator unit (ADGU) has been manually aligned to replace an EDGU. During this time only one of the four cable sets (train A or B) can be energized, due to the fact that it is physically impossible to connect more than one of the four cable sets simultaneously.

There are certain safety-related components which are located in a nonseismic structure. The circuits for these components or devices have the following separations. While in a Category I structure, the circuits for these components are routed with train or channel circuits depending on their application. When they leave the Category I structure, these circuits have been separated physically and electrically to reduce the possibility of damage to more than one redundant circuit.

The RPS, ESF, and ESAS receive their power from the preferred (offsite) and standby (onsite) sources. The normal power and control circuits form the preferred source are routed in conduits or cable trays separate from the alternate power and control circuits. These circuits are identified by a suffix P or R added to their respective cable numbers. (see sections 8.2.1.6 for minimum spatial separation requirements).
The circuits associated with the standby power sources (Class 1E electric systems) are separated into two or more redundant divisions. The circuits between the diesel generators and the 6900-volt shutdown boards are designed for a two division separation (train A and train B).

The feeder circuits from the 125-volt dc vital battery boards to the control 63
buses in the shutdown boards are separated into four divisions (channels I, II, III, IV). Feeder cables to the control buses in the train A shutdown boards are supplied from battery boards I and III and feeder cables to the control buses in the